Virtual reality and virtual environment

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These two terms are usually considered as being synonymous, and are equally used when speaking about a world that is totally recreated by computer simulation. They indeed present similarities, but they also differ in their history, in the contexts in which they are used, and finally in the concepts they are carrying.

The term virtual reality has been coined in 1988 by Jaron Lanier [Lanier, 1988]. However, the same concept has developed under the name of artificial reality, coined by Myron Kruger in 1977 [Krueger, 1977] [Krueger, 1983], who claimed the paternity of the concept. In addition, in 1987, before the Lanier's virtual reality, the term artificial reality had been used by James Foley [Foley, 1987], a renowned researcher in Computer Graphics. The expressions virtual environment and virtual world appeared later.

Indeed, in all these expressions, the term virtual relates to the same concept: "computed by numbers, as opposed to created by physical matter". Virtual reality, virtual environment, virtual words, etc.: they all require computers equipped by computer simulation processes and transducers that transform the digital representations into a perceptible experience (visual, acoustical, mechanical).

However Virtual reality, virtual environment, virtual words, etc. can be differentiated by the position of the human in the respective cases: the immersive position or vis-à-vis position [→ Immersion vs. vis-à-vis].

Virtual Reality and Virtual Environment: immersive situation

The Krueger's and Lanier's approaches are indeed similar. Both emphasize the immersive approach, in the continuity of the meaning of virtual reality initiated by the data glove, data suit and head-mounted display, that were designed as means of completely isolating the user from the real world and putting him within a completely virtual world. Lanier writes: "*virtual reality uses the approach of designing clothing devices, 'computer clothing', which is worn directly over the sense organs. The objective is to instrument this in such a way that you can provide exactly the stimulus to the person's sense organs that they would receive if they were in an alternate reality*". [Lanier, 1988]. This meaning of virtual reality is synonymous to the meaning of virtual environments, in the sense of worlds surrounding the user and being explored by him. Here, the user is here totally immersed in a virtual (i.e. non real) world. In these uses, the interactivity with the Virtual space involves usually the whole human body, large spatial and visual spaces and 3D sound rendering. A Virtual Environment may faithfully recreate an existing real environment or can be completely fictional [Cadoz, 1994] [Milgram et al., 94]. Correlated questions are, at least: co-location problem [→ Co-location], graphical representations of humans [→ Avatar], whole human body motion capture [→ Motion control, high-level], real-time adaptive visual rendering, etc. Classical applications are those involving large spatial space exploration and navigation, but also "*as experimental platform to study the aliened and altered states of the consciousness,* …" [Reingold, 1991].

Virtual reality, artificial reality: vis-à-vis situation

Following the Sutherland's approach that grounds the concept of interactive computer graphics, [Sutherland, 1963], and before, and conversely, to Lanier, J. Foley adopted the vis-à-vis point of view, and introduced force feedback devices in computer graphics

[Foley, 1987]. The Foley's meaning refers to an instrument-in-hand approach. Here, the virtual world is in front of the users. Users are acting, manipulating and transforming the objects of the virtual world, instead of being immersed in it. Also, usually, the interactivity involves rarely the whole body, but focuses on hand and arm manipulation. These virtual realities implemented first hand interactivity and visual feedback. They progressively include, more and more, several sensors, haptic devices, 3D models, physics and dynamics, sound synthesis, hence becoming more and more multisensorial and enactive. Basic correlated questions are, at least: accuracy of the manipulation, accuracy of the visual representation of objects, collision process optimization, dynamics of objects, precision of force feedback [→ Force feedback], cooperation between geometrical models and physical models, etc.

Some remarks

As a first remark, whatever the meaning chosen, one should also note that virtual reality and virtual environment computerized systems are often components to augmented reality systems and to mixed reality systems [→ Reality, augmented and mixed].

As a second, remark, one can notice that the way of categorisation we propose here, based on the distinction between on the one hand virtual environment / immersion and on the other hand virtual reality / vis-à-vis, which allows understanding the differences between these quite-similar terms, is perfectly compatible with the enactive concept: the categorisation is grounded by the type of relation between the humans and the external world.

Going further: reducing the gap

The most important challenges of the future interactive systems is to develop adaptive systems able to merge these two approaches in order to create really virtual worlds in which humans could evolve from an environment point of view when exploring spaces to a vis-à-vis point of view when manipulating objects. The merging, however, is nothing but difficult [→ Immersion vs. vis-à-vis].

References

[Cadoz, 1994] Cadoz C. "Les réalités virtuelles". Collection DOMINOS. Flammarion. Paris 1994. Translated in Spanish (1995), en Korean (1996), en Italian (1996).

[Foley, 1987] Foley, J. D., 1987, Interfaces for Advanced Computing, , (4), 126-35. Scientific American 257.

[Kruger, 1977] M.W. Krueger. Responsive environments. Proc. National Computer Conference. p. 423-433- 1977

[Kruger, 1983] M.W. Krueger, Artificial Reality. Vol I & II. Addison-Wesley, 1983.

[Lanier,1988] J. Lanier. A Vintage Virtual Reality Interview. Whole Earth Review. 1988

[Milgram et al., 94] Paul Milgram, Haruo Takemura, Akira Utsumi and Fumio Kishino. Augmented Reality: A Class of Displays on the Reality-Virtuality Continuum. In "SPIE Proceedings: Telemanipulator and Telepresence Technologies". SPIE. Vol. 2351, pp. 282-292

[Reingold, 1991] Howard Reingold. Virtual Reality (1991). Ed. Simon & Schuster.

[Sutherland, 1963] I.E. Sutherland. Sketchpad: A Man-machine Graphical Communications System. Ph.D. Thesis, 1963. Mass. Institute of Technology

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